THE FIRST FIVE YEARS OF THE PURNELL ACT*

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The year 1930 happens to be the tenth anniversary of the beginning of the active campaign by the Land-Grant College Association for additional Federal support for research work by the agricultural experiment stations that resulted in the passage of the Purnell Act, which was approved February 24, 1925, and it also saw the completion of the fifth year of station activity under the act and the maturity of the financial obligation to be assumed by the Government under the law. For fourteen years after the Adams fund had reached its maximum amount there was no increase in the Federal aid to the agricultural experiment stations, although this was a period of great activity by the stations, especially along the lines of production. The increased burden of this work fell entirely upon the States and their contributions to the common cause of agricultural research increased from $2,222,425 in 1911 to $9,141,975 in 1925.

Realizing that the benefits of agricultural research were not limited by State boundaries but were often of nation-wide application, and recognizing the need of funds in order that the stations might meet the increasing demands for more work along established lines and to make it possible to engage in research in new lines, the Executive Body of the Association of Land-Grant Colleges and Universities, at its meeting at Springfield, Mass., October 19-22, 1920, adopted a resolution which authorized the Executive Committee of the association to seek the passage by Congress of an act that would secure to the agricultural experiment stations additional funds "to be applied to research in agricultural economics, home economics, and other country life subjects, including research in agricultural production in addition to the subjects

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provided for by existing law." Dean Mumford of the Missouri station and Dean Mann of the New York Cornell station were asked to "prepare a tentative measure in behalf of research, drafting the same in accordance with the trend of the discussion of the Executive Body." A detailed history of the efforts made to secure the legislation now known as the Purnell Act is given in the Proceedings of the Association of Land-Grant Colleges, 1925, pp. 63-68.

It is generally considered a wise policy to review, at certain intervals, the accomplishments during a definite period not only to learn of the successes and failures, if there have been any, but also to ascertain whether the objectives are being attained so that the information can be used to chart future developments.

It is the purpose of this paper to review, briefly, some of the administrative and other accomplishments under the Purnell Act from the inception of the work up to the time when the obligation of the Government to supply annually increasing sums was reached.

One of the matters of considerable concern to those interested in the Purnell Act was the reaction of State legislatures and others responsible for the allotment of funds to the experiment stations. In some quarters there was apprehension lest the granting of additional Federal funds to the stations would result in a somewhat corresponding reduction of State or college funds. This has not taken place in the aggregate or in any important specific instance. The total income of all the stations for 1925, the year before the Purnell fund became available, was $10,581,000, of which $1,440,000 came from the Federal Government and $9,141,000 from sources within the States. For the year 1929, the last year for which the Office of Experiment Stations has complete data, the total income of the stations was $16,408,000, of which $3,840,000 came from

the Federal treasury, and $12,568,000 from the States. For the fiscal year ended June 30, 1930, the year of the maturity of the contributions to the Purnell fund, the estimated income of the stations was about $17,200,000, of which $4,320,000 came from the Government and $12,880,000 from the States. For each of 14 stations the increased State support has been greater than the sums they received under the Purnell Act. In 11 States the direct State support in 1929 was less than that of 1926, but in most cases the difference was not very great. The institutions with which some of these stations are affiliated have furnished aid such as increased quarters, personnel, equipment, and the like, that have more than equaled the apparently reduced allotment of funds. In not a single instance has the State's contribution to the station's support been reduced proportional to the increase received under the Purnell Act.

Another matter of interest is that of the use of Purnell funds for such capital expenditures as buildings and lands. While the law permits the use of not to exceed 10 per cent of the fund for buildings and lands, the stations have observed the spirit of the act by conserving the funds for research purposes. Only two or three stations have expended for any one year the total proportion of the fund allowed by the act and the highest average percentage spent by all the stations was 1.87 per cent in 1926. In 1929 the average percentage of the fund used for buildings and lands was 1.3 per cent. Ten stations have had no charge against the Purnell fund for buildings and lands. This is not to be considered in any sense a criticism of stations which have so used a portion of the funds but the statement is made as a further illustration of how the fund is being supplemented by the States and the institutions with which they are affiliated. In 1929 the States contributed $877,862 toward buildings and lands for station purposes as contrasted with $38,557 of the Federal funds

so employed.

It may not be without interest to contrast the sums paid from the Hatch and Adams funds for some major objects of expenditures before and after the passage of the Purnell Act. In 1925 there was spent by the stations from Federal funds for salaries, $1,110,088; for publications, $18,261; for laboratory equipment, $18,799; for laboratory supplies, $21,342; and for travel $20,922. In 1929, the year before the Purnell fund reached its maturity, the same items of expenditure from Federal funds were; Salaries, $2,656,376; publications, $72,496; laboratory equipment, $90,646; laboratory supplies, $48,697; and for travel, $145,698. The technical personnel of the stations increased during the same five-year period from 2,385 to 3,096 persons, or a total increase of 711. An analysis of the figures shows that the Purnell fund made it possible for the stations to increase their staffs, pay better salaries, provide more adequate equipment and supplies for their laboratories, and to increase their publications. The number of station publications has increased more than 100 per cent under the stimulus of the Purnell fund. It is to be understood, of course, that by no means are all the publications issued by the stations paid for from Federal funds. The increase of more than 700 per cent in the amount of funds used for travel has been due in the major part to the extension of the stations' activities to the fields of agricultural economics, rural sociology, and home economics, which of necessity require a large amount of travel connected with their research.

It is assumed ~~that you~~ are all familiar with the language of the Purnell Act. It provides essentially for research in agriculture and the publication of the results of the researches. Following the passage of the act, a conference of representatives of the land-grant colleges, experiment stations, and

of the U. S. Department of Agriculture was held at St. Louis on April 22, 1925, to consider the policies to be adopted for the administration of the act. As a result of the conference it was decided that the administration of the Purnell fund should follow closely the principles laid down for the Adams fund, namely, that it should be administered on the basis of a program of specific projects and a budget of expenditures to be submitted annually for consideration and approval. The regulations for the administration of the act were set forth in a circular letter, dated May 20, 1925, signed by the Secretary of Agriculture and sent to all station directors.

All the States promptly accepted the terms of the act, and a Deficiency Act of Congress having supplied the funds, work was begun on July 1, 1925. During the first year of the application of the Purnell Act there were approved 680 projects, most of them in the less developed fields of research named in the act. Of these 215 were in agricultural economics, 91 in home economics, 23 in rural sociology, and 16 in agricultural engineering, leaving 335 in fields formerly occupied by the stations. In the forthcoming classified list of station projects which were active in 1929-30, there are enumerated 1,221 Purnell projects as follows: Agricultural economics, 310; home economics, 125; rural sociology, 38; agricultural engineering, 50; all others, 698. Nearly half of the Purnell projects are in the newer fields of research authorized by the act. During the five-year period 519 projects were completed or removed from the list, making a total of 1,740 projects that have been supported wholly or in part by Purnell funds.

When one considers the difficulties experienced in organizing new lines of research and the scarcity of available research workers, the progress made in the new fields of investigations authorized by the act has been very encouraging.

For the period under review the States received under the Purnell Act $9,600,000. Of this sum there was allotted to research in agricultural economics, $3,113,000; to rural sociology, $401,000; and to home economics, $1,194,000, or a total of $4,708,000, nearly one half of the Purnell appropriations for these years.

It is impracticable to recount all that has been accomplished in research with the Purnell fund from the time of the first appropriation under the act to the date when the fund attained its maximum amount. However, an attempt will be made to review briefly some of the developments at the stations that can be properly accredited to the increased support made available under the act. At many, if not all, of the stations the fund was used to supplement the support allotted to projects already in progress. This has made possible more rapid progress than otherwise would have been the case. In addition work was undertaken or extended in fields of research that previously had not been supported by Federal funds. In some of these fields there has been marked activity.

For the first year of the Purnell fund the stations had approximately 100 workers in agricultural economics and rural sociology. At the close of the five-year period under review there were 230 research workers in agricultural economics and 35 in rural sociology, or an increase in personnel of 165 per cent.

Since 1925 there has been marked improvement in the methods and programs of research in agricultural economics and rural sociology, and there has been a pronounced development of cooperation between the stations, the U. S. Department of Agriculture, and other agencies. As an illustration, practically every State in which cotton is produced in commercial quantities is actively cooperating with the U. S. Department of Agriculture in studies on the relation of

grade and staple length to the price of cotton in the farmer's market, and on a plan for estimating the grade and staple length of American cotton. These, when completed, will furnish a national inventory of the quality of this crop.

There has been some disposition, on the part of those especially interested in the relation of marketing to the present agricultural situation, to criticize the experiment stations for not sufficiently emphasizing this field of research in agricultural economics investigation. An analysis of the projects in agricultural economics now active at the stations shows that 162 out of a total of 463 economics projects relate to phases of the marketing problems. Such work is in progress by the stations in all but two of the States. A recent survey of the northeastern States, made by the director of the New Hampshire Experiment Station, shows that of 137 projects in agricultural economics at the stations represented, 53 relate to marketing.

In 1925 there were but 11 stations at which rural sociological work of any kind was in progress. At the present time 21 stations are engaged on this type of research. There are still 27 States where no work of this character is being carried on, seeming to indicate room for considerable expansion in this field of agricultural research. Through the aid of several national cooperative committees there has been outlined a project on Rural Family Living, which, it is expected, will serve as a guide for the further development of studies of rural family life.

At the time of the passage of the Purnell Act, home economics research received Federal support in only four States. In 1930, 125 projects in 44 States were receiving support from Purnell funds. These projects may be grouped under three heads, investigations in foods and nutrition, in home management, and in textiles and clothing. By far the greatest number of home economics projects are

in foods and nutrition, a field in which there had been considerable development before the Purnell Act went into effect, and in which the methods for research had been formulated. The participation of a number of the experiment stations in the national cooperative project on Factors Affecting the Quality and Palatability of Meat has stimulated research in the field of home economics. Further studies of the dietary habits in different sections of the country have yielded significant and useful results.

Home management studies were later in being developed and as a consequence few projects have been completed. Use-of-time studies on a fairly uniform plan have been undertaken by a number of stations. A comparison of the published results of three rather widely distributed station investigations has shown a surprising uniformity in the distribution of the time of farm home makers. An interesting fact brought out by studies at two stations was that the use of improved household equipment did not materially reduce the amount of time devoted to household tasks, but did tend to raise the standards of living.

Research in textiles and clothing has been slowly developed at the stations, owing to the small number of trained workers that were available and the high cost of establishing laboratories for textile research. Several stations have established textile laboratories and their research on phases of textiles and clothing should show important results.

One of the promising signs for the future of home economics research is the recognition that those who expect to take part in such work should be given more training in the fundamental sciences than is now include in general home economics courses. Several land-grant colleges have adapted their courses to meet this requirement.

The Purnell Act appears to have been an influential factor in formulating

and stabilizing research in agricultural engineering, which is becoming an important feature of the work of the agricultural experiment stations. There are at present at the stations the equivalent of about 75 full time research workers who are engaged in research which is expected to reduce the cost of agricultural production. Manufacturers of farm machinery have cooperated whole-heartedly with the stations in this undertaking, and already there have been developed methods and equipment that are more efficient and economical of operation than those previously in use. These investigations have led to important improvements, for example, in tillage implements, tractors, harvesting machinery, methods of storing farm products, use of water in irrigation, methods for preventing soil erosion and water run-off, and in the use of electricity on the farm. The stations' work on the adaptation of electricity to new agricultural uses so stimulated interest in the matter that an exhaustive survey of the problems of agricultural electrification is now in progress, the result of which will doubtless furnish a basis for a unified research program in this field.

In the older fields of station work it is more difficult to point to concrete examples of progress that can be definitely accredited to the influence of the Purnell fund. When this fund became available, many projects supported by other funds were transferred to it in an uncompleted state for further study and it would be manifestly unfair to accredit the results to any one source of support. That the Purnell fund has stimulated work in the general field of agricultural production is indicated by the constantly increasing number of projects, the ratio of increase in new projects being about the same for the earlier and the later fields of investigation.

Investigations on soils and fertilizers have been substantially extended and strengthened with the aid of the Purnell fund. Notable advance has been

made in improving experimental technic and research methods, especially in providing better control and measurements of experimental factors and conditions. Especially significant progress has been made in the study of base exchange and soil colloids in relation to soil fertility; nature and means of improving alkali, acid, and other deficient soils; effect of drainage and erosion on soil fertility; nitrification, nitrogen fixation, and other bacterial reactions in soils, and soil improvement by means of manures and fertilizers.

In animal husbandry the trend of the Purnell fund research has been especially along lines of the effect of various deficiencies in feeds and forages and of the factors that may influence the quality and palatability of meat; breeding problems with various classes of livestock, involving genetical studies of reproduction, inbreeding, crossbreeding, disease resistance, etc.; range cattle management with special reference to winter feeding; and relation of light, mineral matter and other factors to rickets and similar diseases of poultry. In all of these lines of investigation definite progress has been made.

Some of the leading Purnell projects in dairying have dealt with the breeding and feeding of dairy cows, factors that influence the quality of milk and milk products, methods for removing objectionable flavors from dairy products and various manufacturing problems connected with the dairy industry.

In field crops the trend of the Purnell projects has been toward the study of specific problems of crop production that are fundamental in their nature. Many stations are giving attention to crop improvement and the genetics of crop plants. A number of stations in the Corn Belt and the U. S. Department of Agriculture are cooperating in a regional project dealing with various problems of corn improvement. This work has shown already the mode of inheritance of a number of important characters, it has revealed some inaccurate conclusions

drawn from previous work, and it has contributed much to an understanding of the principles involved in corn breeding and to the improvement of the technic of the work. As a practical result of some of this work, there are available to growers a number of hybrid-inbred strains that appear to be very promising. Forage plants and pastures, particularly their proper management in connection with systems of farming, are receiving much attention as are the relation of environment to the composition of the crop, its resistance to disease, and winter hardiness.

In horticulture the Purnell fund has been applied mainly to long time investigations dealing with such subjects as fruit and vegetable improvement through crossing and selection, pollination and sterility of fruits, nutrition and fertilizer requirements, rootstocks, and storage and handling of fruits.

In entomology and plant pathology the investigations supplemented by Purnell funds have dealt with the causes and means of their control of various diseases and insect pests. This has involved many life history studies and tests of insecticides and fungicides. Breeding of plants for disease resistance has been given a prominent place in the stations' programs. Soil moisture and temperature relations of the host plant and its fungus enemies have been found to be correlated and practices have been worked out that, if adopted, will reduce losses. To solve the arsenical spray residue problem the entomologists have cooperated with chemists and horticulturists in an effort to get efficient substitutes for arsenicals and to find practical methods of removing the residue from sprayed fruit. Considerable progress on the solution of this problem has been reported. For example, it has been demonstrated that sodium fluosilicate equals or surpasses arsenicals in deadliness to certain insects, and the small residue left on sprayed fruits is practically negligible from the standpoint of

human health. Effective methods for removing spray residues have been developed and they are in extensive use.

Among plant pathologists the matter of spraying and dusting is being given consideration and very active work is in progress in an effort to find substitutes for the standard fungicides, Bordeaux mixture, and lime sulphur, which under certain conditions are known to cause injury. Important advance has been made during the last few years in the control of seed-borne diseases through refined methods of seed treatment and the discovery of new materials for this purpose. The stations have added very much to our knowledge of degeneration, or virus, diseases, although the causal agency remains unidentified.

Purnell projects in veterinary science have contributed greatly to solving livestock problems. Investigations on infectious abortion of mares resulted in the preparation of a bacterin that is extensively used as an immunizing agent with marked success, and the knowledge of this disease in other animals has been greatly extended. The cause of an obscure disease, locally known as the walking disease, which affects horses and cattle, has been found to be due to a toxic agent derived from a common range plant. Lack of vitamin D in the ration fed poultry has been found to lower their resistance to infestation by intestinal nematodes. Fowl pox has been the subject of a number of investigations which have led to the widespread vaccination of flocks, and a consequent lowering of losses.

Examples of the beneficial results of researches under the Purnell fund could be extended almost indefinitely, if time were available, but the foregoing illustrations may be sufficient to show that the fund has been and is being well applied to the purpose stated in the act, namely, "the establishment and maintenance of a permanent and efficient agricultural industry and . . .

the development and improvement of the rural home and rural life."

S u m m a r y

The Purnell Act has made it possible to greatly enlarge the fields of experiment station activity, increase their personnel, pay better salaries, provide better trained research workers along some lines, and to secure more prompt publication of the results of research.

It has not resulted in a decrease in State or institutional support of the agricultural experiment stations.

The stations have made good use of the Purnell funds in prosecuting their research.

The results attained in the first five years of the Purnell Act have been of great scientific and practical importance, fully justifying the faith of those who were instrumental in securing its passage that it would aid in solving some of the problems of rural life.